REMARKS

Upon entry of this Reply, claims 1-11 will remain in this application. Reconsideration of the application is requested.

Reference numbers 39, 301, and 302 have been eliminated from Figures 3 and 14 appearing in the replacement figures appended to this Reply. The objection to the drawings set forth in section 2 on page 2 of the Office Action should be withdrawn.

Reference number 34 appears in Figure 5 of the replacement figures appended to this Reply. Reference number 18 appears in Figure 25 of these replacement figures. The objection to the drawings set forth in section 3 on page 2 of the Office Action should be withdrawn.

A new title has been supplied as required.

The wording of claim 11 is acceptable pursuant to MPEP §608.01(n)(I)(A). Reconsideration and withdrawal of the objection set forth in section 5 on pages 2-3 of the Office Action are in order.

The claim amendments appearing above were made after consideration of the comments provided in section 6 on page 3 of the Office Action. The "main passage" referred to in claim 1 does not form part of the flow rate measuring device specified, and positive recitation of a main passage in claim 1 is unnecessary. All of the claims in this application now fully comply with the requirements of 35 U.S.C. §112, second paragraph.

Reconsideration of the rejection of claims 1-10 based on U.S. Patent 5,892,146 to Kobayashi et al. in view of U.S. Patent 5,631,415 to Igarashi et al. is requested.

The air flow meter of the Kobayashi et al. patent does not have means for detecting a direction of air flow. Accordingly, when detecting back current with the sensing device when the back current (the air flow from the engine toward the direction of the air cleaner) is generated within the intake duct in correspondence to the operation state of the engine, an error in measurement is generated. In particular, the air flow rate caused by the back current is an air flow rate which was once measured by the flow rate measuring device but returns without entering into the engine. Therefore, the air flow rate entering into the engine can be securely measured only by subtracting from a flow rate measured in the past. In the flow rate measuring device shown in the Kobayashi et al. disclosure, since the returning air flow rate (back current) can not be distinguished from the air flow rate (forward current) entering into the engine, it is again measured as the air flow rate entering into the engine. Accordingly, in the flow rate measuring device of Kobayashi et al., a large positive error is generated if the back current is measured. In order to accurately measure the air flow rate in the Kobayashi et al. configuration, it is necessary that at least the sensing device does not detect the back current. In order to achieve this, in Kobayashi et al., intrusion of the back current is prevented by employing the L-type sub-passage described lines 52-56 in column 5.

The flow rate measuring device of the present invention, by contrast, can detect the directions of the forward current and the back current, and outputs a negative flow rate signal when the back current is detected by the sensing device. It is not

necessary to prevent back current intrusion when back current is generated as is the case in the Kobayashi et al. air flow meter.

In order to accurately detect the direction at a time of pulsation, it is necessary to respond to a frequency of about 66 Hz at 2000 rpm in a 4-cylinder engine. In order to respond to the frequency by way of a thermal-type flow rate measuring device, it is necessary to improve thermal response. A flow rate measuring device having a direction detecting function in accordance with the present invention is structured to have a resistance to carry out sensing in the thin film portion. Such structure has a small thermal capacity and a higher thermal response against the flow rate than that of the flow rate measuring device disclosed in Kobayashi et al. In a motor vehicle environment, however, the thin film structure is easily broken. Since air containing dust and contaminants flows within the intake duct in which the flow rate measuring device is arranged, the thin film can be broken when the air collides with the thin film.

It is possible to secure reliability, even in a motor vehicle environment, by employing structure having a curved portion upstream of the sensing device and generating an inertia force in this upstream curved portion so as to prevent dust or the like from colliding with the thin film portion. This is accomplished according to the present invention, by which it is possible to provide a flow rate measuring device which can secure back current detection and reliability. In the structure shown in Figure 1 of the present application, having a curved portion at an upstream side, while the sensing device can accurately

detect the forward current and the back current, it is hard for the back current to enter into the sub-passage. It is therefore impossible to sufficiently reduce the error when the back current is generated. Accordingly, it is one object of the present invention to introduce the back current into the sub-passage.

Figure 1 of the Kobayashi et al. patent appears to have a curve at an upstream location; however, as is apparent from Figure 2, dust or the like directly collides with the sensing device, the sub-passage is of an L-type as described in lines 54 to 56 of column 5, and a curve such as that of the present invention is not provided. Again, in the Kobayashi et al. flow rate measuring device, the means for detecting the flow direction is not provided, and the sub-passage has a shape for preventing back current from intruding as much as possible.

The present invention, by contrast, has a detection element for detecting the flow direction and aims to positively introduce the back current to the sub-passage, which is hard to do in view of securing reliability. The present invention is completely different from the flow rate measuring device of the Kobayashi et al. meter, and it is impossible to derive the present invention from the structure forming the subject matter of the Kobayashi et al. patent.

The projection near the outlet in the Igarashi et al. device is formed for the purpose of reducing an influence of the drift generated by the shape of the air cleaner when the air flows from the air cleaner in the direction of the engine. Accordingly, the projection is not formed for reducing the flow rate error generated by the back current. The flow rate measuring device

forming the subject matter of the Igarashi et al. patent does not have means for detecting a direction in the same manner as the Kobayashi et al. device. Accordingly, at a time when the back current is generated, a flow rate error is generated, when detecting the back current in the sensing portion, for the same reason as in the case of Kobayashi et al. mentioned above.

Further, in the Igarashi et al. device, as is apparent from Figure 2, since the structure is made such that dust or the like directly collides with the sensing device, the sub-passage is of an L-type. There is no consideration of providing a curve such as that of the present invention. The flow rate measuring device of the Igarashi et al. patent does not have means for detecting a flow direction, and the sub-passage has a shape for preventing a back current from intruding as much as possible. The present invention, by contrast, has a means for detecting a flow direction and aims to positively introduce the back current to the sub-passage, which is hard to accomplish. No possible combination of the Kobayashi et al. and Igarashi et al. disclosures relied on would result in a flow rate measuring device comprising, in addition to other elements, a detection element capable of measuring gas flow rates in forward and backward directions and introducing means to introduce a backward flow of a main passage into a sub-passage through an outlet as claim 1 particularly defines.

Claim 1 is patentable for reasons discussed above. The rest of the claims in this application depend on claim 1 and are patentable as well.

This application is now in condition for allowance. Should the Examiner have any questions after considering this Reply, the Examiner is invited to telephone the undersigned attorney.

Respectfully submitted,

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